Document made available under the Patent Cooperation Treaty (PCT)

International application number: PCT/GB05/000121

International filing date: 14 January 2005 (14.01.2005)

Document type: Certified copy of priority document

Document details: Country/Office: GB
Number: 0400813.2
Filing date: 14 January 2004 (14.01.2004)

Date of receipt at the International Bureau: 09 February 2005 (09.02.2005)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b)

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1. Your reference — REP07660GB

0400813.2

2. Patent application number *(The Patent Office will fill this part in)* — 14 JAN 2004

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

Sherwood Technology Ltd.
Unit 3
Wheldon Road
Widnes
Cheshire
WA8 8FW

Patents ADP number *(if you know it)* — 8092179003

If the applicant is a corporate body, give the country/state of its incorporation — GB

4. Title of the invention — Laser Imaging

5. Name of your agent *(if you have one)* — Gill Jennings & Every

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

Broadgate House
7 Eldon Street
London
EC2M 7LH

Patents ADP number *(if you know it)* — 745002

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Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

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Description	22
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11. I/We request the grant of a patent on the basis of this application.

For the applicant
Gill Jennings & Every

Signature Date 14 January 2004

12. Name, daytime telephone number and e-mail address, if any, of person to contact in the United Kingdom

PERRY Robert Edward
020 7377 1377

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LASER IMAGING

BACKGROUND OF THE INVENTION

In previous patent applications, i.e. British Patent Application Nos. 0204622.5, 0106603.4, 0108360.9, 0114977.2, 0226383.8, 0317829.0. 0317860.5 and 0326392.0, and also applications claiming priority from them, including US Patent Application Nos. 10/344393 and 10/380381 (the content of all of which are incorporated herein by reference), we have described laser imaging and materials that can be used for that purpose. Examples that are provided typically use high energy lasers.

It is well known that there are many attractions in using non-contact near-IR sources, in particular diode lasers, to generate images from coatings for applications such as variable information packaging. Favourable attributes of diode lasers such as economy, portability and ease of use are attractive for current needs in the packaging industry, such as in-store labelling.

By incorporating into ink formulations, materials which absorb radiation from far-IR to mid-IR sources such as heat (~1 to 20μm) and CO_2 laser (~10 μm), coatings have been produced which will generate a distinct coloured image on exposure to this wavelength of energy but **not** near-IR sources. By incorporating into these same ink formulations, materials which absorb radiation from near-IR sources such as Diode laser (~1 μm), coatings have been produced which will generate a distinct coloured image on exposure to near, mid or far-IR.

Copper salt materials have been previously used (see US5840791A, US20030191223A and US20020016394A) as "laser light-active" compounds. They have been utilised in thermoplastic polymer mouldings, thermoplastic resin and thermoplastic polymer powder compositions etc. for laser marking of plastic components. Inorganic copper salts such as copper(II) hydroxy phosphate, copper(II) pyrophosphate and copper(II) sulphate etc. have been used. Organic copper salts such as copper(II) fumarate, copper(II) maleate and copper(II) oxalate have been used.

Summary of the Invention

The invention utilises the presence of one or more metal salts as a functional IR-absorber/colour developer material which, on absorption of radiation from laser sources can directly produce a colour-forming reaction when in combination with an oxymetalanion component in an applied coating, to generate a distinct coloured image. Alternatively, a

colour-forming component is used, to generate a distinct image. Thus the potential of utilising diode and CO_2 laser for imaging applications of packaging can be realised.

Description of preferred embodiments

Materials which can be used in the invention are described in our earlier Applications (see above), to which one or more metal salts are added. A preferred metal is copper. Others are salts of monovalent or multivalent metals, e.g transition metals such as Fe and Zn.

The Copper salt may be one or more of a range of materials for example copper(II) hydroxyphosphate or copper(II) pyrophosphate.

The oxymetalanion component may be one or more of a range of materials for example ammonium octamolybdate, bis2-(ethylhexylamine) molybdate or di(cyclohexylamine) molybdate etc.

The "Colour Forming" component may be one or more of a range of conventional colour former materials such as phthalides, fluorans and leuco dyes for example crystal violet lactone.

Copper salts have been initially evaluated at suitable concentrations using a range of appropriate ink formulations with inherent but chemically different colour change capabilities and characteristics. With coating onto various substrates laser imaging at near-IR wavelengths (700 – 2000 nm) has been achieved.

An objective has been to demonstrate that it is possible for coatings to produce controllable images when activated by an appropriate laser source such as CO_2 or diode. The primary objective was to demonstrate that coloured and for controllable images can be achieved on exposure to near-IR wavelength laser sources (700–2000 nm) **only** with the presence of **both** a "Copper Salt" in addition to an oxymetalanion, for example ammonium octamolybdate, or a colour-forming component such as violet crystal lactone. By application of liquid film-forming inks onto various substrates to produce coatings capable of distinct colour change it was shown that exposure to near-IR sources would produce dramatically different results dependent primarily on the formulation of the ink.

Due to the remarkable character of the ink/coatings in producing a black image on exposure to diode laser wavelengths when including a copper salt and oxymetalanion, this may be further expoited by differentiating between activating sources.

Further, due to the remarkable character of the ink/coatings in producing a coloured image on exposure to diode laser wavelengths when including copper salt and "colour

forming" component, this may be further exploited by differentiating between activating sources and to produce a range of different colours.

To illustrate one aspect of the invention the following fluid inks and applied coatings were prepared using the inclusion, exclusion or combination of the copper salt and oxymetalanion within the composition.

1. Dispersion in water-based inks.
2. Dispersion in solvent-based inks.

The initial results demonstrate -

a) Copper Salt in combination with oxymetalanion does significantly absorb CO_2 **and** Diode laser radiation,

this is shown by a strong effect of the applied coating and production of a controlled BLACK image on exposure to both CO_2 **and** Diode laser sources.

b) Copper Salt **not** in combination with oxymetalanion does significantly absorb Diode laser radiation,

this is shown by the burning but not controlled imaging of the polymer binder of the applied coating and substrate on exposure to Diode laser source.

c) Copper Salt **not** in combination with oxymetalanion does not significantly absorb CO_2 laser radiation,

this is shown by slight burning but not controlled imaging of the applied coating on exposure to CO_2 laser source.

d) Oxymetalanion **not** in combination with Copper Salt does not significantly absorb Diode laser radiation,

this is shown by no effect of the applied coating on exposure to Diode laser source.

e) Oxymetalanion **not** in combination with Copper Salt does significantly absorb CO_2 laser radiation,

this is shown by a strong effect of the applied coating and production of a BLACK image on exposure to CO_2 laser source.

CHP – Copper (II) Hydroxy Phosphate

CPPH – Copper (II) Pyrophosphate Hydrate

Examples (Set A)

1. "Water-Based Inks" range

Water-based inks of PVOH solution stabilised dispersion in acrylic emulsion has been partly evaluated. Using additions at suitable concentration of CHP strong, well-defined and

distinct colour changes have been demonstrated with the Prototype Diode Laser and CO_2 Laser when applied by K-bar on different substrates.
(see Tables 1, 2 and 3)

Typical "Inactive" Ink Formulation (I) (% w/w)

Binder	40
Copper Salt	5
Fluid (Water/Amine/Surfactant etc.)	55

Typical "Inactive" Ink Formulation (II) (% w/w)

Binder	26
Active Pigment	27
Fluid (Water/Amine/Surfactant etc.)	47

Typical "Active" Ink Formulation (% w/w)

Binder	24
Active Pigment	24
Copper Salt	6
Fluid (Water/Amine/Surfactant etc.)	46

Copper Salt	e.g.	Copper(II) Hydroxy Phosphate, Copper(II) Pyrophosphate Hydrate etc
Binder	e.g.	Gohsenol GH-17 polyvinylalcohol, Texicryl acrylic emulsion etc.
Oxymetalanion	e.g.	ammonium octamolybdate, Di(cyclohexyl)amine molybdate, Bis-2-(ethylhexyl)amine molybdate etc.
Fluid	e.g.	water etc.
Pigment	e.g.	Zinc Stearate etc.

Table 1 - Sample Formulation

(for laser imaging evaluation of Example see Table 2)

Example	Component	% w/w
A	Scott Bader Texicyryl 13-011	40
	Copper (II) Hydroxy Phosphate	5
	Fluid	55
B	Scott Bader Texicyryl 13-011	25
	Gohsenol GH-17	1
	Ammonium Octamolybdate	27
	Fluid	47
C	Scott Bader Texicyryl 13-011	23
	Gohsenol GH-17	1
	Copper (II) Hydroxy Phosphate	6
	Ammonium Octamolybdate	24
	Fluid	46

Table 2 – Diode Laser Imaging Evaluation

(for formulation of Example see Table 1)

Example	Copper Salt Type	Level % w/w	Unimaged	Exposed (~ 830 nm)
A	CHP	5	Off-White Green	Burning
B	n/a	0	White	None
C	CHP	6	Off-White Green	**BLACK**

Table 3 – CO_2 Laser Imaging Evaluation

(for formulation of Example see Table 1)

Example	Copper Salt Type	Level % w/w	Unimaged	Exposed (~ 10,000 nm)
A	CHP	5	Off-White Green	Burning
B	n/a	0	White	**BLACK**
C	CHP	6	Off-White Green	**BLACK**

<u>"Solvent-Based Ink" range</u>

Solvent-based inks of stabilised dispersion in acrylic, alcohol/ester solution (**no** conventional colour former present) has been partly evaluated. Using additions at suitable concentration of CHP strong, well-defined and distinct colour changes have been demonstrated with the Prototype Diode Laser and CO_2 Laser when applied by K-bar on different substrates.

(see Tables 4, 5 and 6)

Typical "Inactive" Ink Formulation (I) (% w/w)

Binder	26
Copper Salt	5
Fluid (Alcohol/Ester etc.)	69

Typical "Inactive" Ink Formulation (II) (% w/w)

Binder	19
Active Pigment	22
Pigment	1
Fluid (Alcohol/Ester etc.)	58

Typical "Active" Ink Formulation (% w/w)

Binder	18
Active Pigment	21
Copper Salt	5
Pigment	1
Fluid (Alcohol/Ester etc.)	55

Copper Salt	e.g.	Copper(II) Hydroxy Phosphate, Copper(II) Pyrophosphate Hydrate etc
Binder	e.g..	Ineos Elvacite 2013, 2028, 2043, Pioloform PolyvinylButyral, ICI Nitrocellulose etc.
Fluid	e.g.	Ethanol, Ethyl Acetate etc.
Oxymetalanion	e.g.	ammonium octamolybdate,

Di(cyclohexyl)amine molybdate,

Bis2-(ethylhexyl)aminemolybdate etc.

Pigment e.g. Fumed Silica,

Zinc Stearate etc.

Table 4 - Sample Formulation

(for laser imaging evaluation of Example see Table 5)

Example	Component	% w/w
D	Elvacite 2028	26
	Copper (II) Hydroxy Phosphate	5
	Fluid	69
E	Elvacite 2028	19
	Ammonium Octamolybdate	22
	Fumed Silica	1
	Fluid	58
F	Elvacite 2028	18
	Ammonium Octamolybdate	21
	Copper (II) Hydroxy Phosphate	5
	Fumed Silica	1
	Fluid	55

Table 5 – Diode Laser Imaging Evaluation

(for formulation of Example see Table 4)

Example	Copper Salt Type	Level % w/w	Unimaged	Exposed (~ 830 nm)
D	CHP	5	Off-White Green	Burning
E	n/a	0	White	None
F	CHP	5	Off-White Green	**BLACK**

Table 6 – CO_2 Laser Imaging Evaluation

(for formulation of Example see Table 4)

Example	Copper Salt Type	Level % w/w	Unimaged	Exposed (~ 10000 nm)
D	CHP	5	Off-White Green	Slight Burning
E	n/a	0	White	**BLACK**
F	CHP	5	Off-White Green	**BLACK**

Experimental Method

- Inks were prepared by dispersing Copper Salt and Oxymetalanion materials in water based emulsions or solutions of polymer binder and solvent based solutions of polymer binder using stirring and milling.
- Coatings were prepared by application onto paper, board or foil substrate with 1 or 2 x K-bar 2.5 and hot-air drying.
- Coated substrates were exposed to Diode or CO_2 Laser sources and the effect evaluated.

Summary

a) Water-borne dispersion of Copper Salt and oxymetalanion in polymer solution or emulsion.

b) Solvent-borne dispersion of Copper Salt and oxymetalanion in polymer solution.

c) Solvent-borne dispersion of Copper Salt and solution of oxymetalanion in polymer solution.

i) The colour change characteristics of the ink type was evaluated on various substrates **with** suitable Copper Salt **and** oxymetalanion.
Distinct colour change can be initiated with a near-IR source where the image achieved is not variable due to formulation of the ink. Therefore exposure of a coating applied from the ink to an appropriate IR source such as Diode or CO_2 Laser will produce a distinct image.

ii) The colour change characteristics of the ink type was evaluated on various substrates **with** suitable Copper Salt **but without** active pigment.
Distinct colour change can **not** be initiated with a near-IR source where the failure is controlled by the formulation of the ink. Therefore exposure of a coating applied from the ink to an appropriate activating IR source such as Diode **or** CO_2 Laser will **not** produce a standard distinct image where the failure is controlled by the formulation of the ink.

iii) The colour change characteristics of the ink type was evaluated on various substrates **without** suitable Copper Salt **but with** oxymetalanion.
Distinct colour change **can not** be initiated with a near-IR source where the failure is controlled by the formulation of the ink. Therefore exposure of a coating applied from the ink to an appropriate activating IR source such as Diode laser will **not** produce a distinct image.

However, marking **can** be initiated with an alternative IR source. Therefore exposure of a coating applied from the ink to an appropriate activating IR source such as CO_2 Laser will produce a distinct image dependent upon the ink type.

Ink Type a) - Water-Based Inks

The Copper Salt can be one or more of a range of inorganic materials such as copper(II) hydroxide phosphate, copper(II) pyrophosphate hydrate etc.

The oxymetalanion can be one or more of a range of water compatible oxy metal anion materials such as Ammonium Octamolybdate etc.

The binder can be one or more of a range of water soluble, alkali soluble or emulsion polymers such as polyvinyl alcohol, styrene acrylic, hydroxypropyl cellulose, etc.

The fluid can be one or more of a range of water compatible liquids etc.

One or more of a range of additives can be utilised, surfactants or lubricants such as zinc stearate etc.

The IR sensitive coating can be applied by a range of methods such as flood coating, flexo/gravure etc.

The IR sensitive coating can be applied to a range of substrates such as paper, paperboard, flexible plastic film, corrugate board etc.

Ink Type b) – Solvent-Based Inks

The Copper Salt can be one or more of a range of inorganic materials such as copper(II) hydroxide phosphate, copper(II) pyrophosphate hydrate etc.

The oxymetalanion can be one or more of a range of solvent compatible oxy metal anion materials such as Ammonium Octamolybdate etc.

The binder can be one or more of a range of solvent soluble polymers such as acrylic, polyvinylbutyral, nitrocellulose etc.

The fluid can be one or more of a range of solvents such as ethanol, ethylacetate, isopropanol, methylethylketone etc.

One or more of a range of additives can be utilised, surfactants or lubricants such as zinc stearate etc.

The IR sensitive coating can be applied by a range of methods such as flood coating, flexo/gravure etc.

The IR sensitive coating can be applied to a range of substrates such as paper, paperboard, flexible plastic film, corrugate board etc

Potential further types of medium for Copper Salt / Oxymetalanion applications,

UV curable flexographic inks,
UV curable offset inks,
Conventional offset inks,
Melt extrudable polymer,
Powder Coatings,
Etc.

Examples (Set B)

To illustrate the scope of the invention the following fluid inks and applied coatings were prepared using the inclusion, exclusion or combination of the copper salt and "Colour Forming" component within the composition.

1. Dispersion in water-based inks.
2. Dispersion in solvent-based inks.

The initial results demonstrate -

a) Copper Salt in combination with "Colour Forming" Component does significantly absorb CO_2 **and** Diode laser radiation,
this is shown by a strong effect of the applied coating and production of a controlled COLOURED image on exposure to both CO_2 **and** Diode laser sources.

b) Copper Salt **not** in combination with "Colour Forming" Component does significantly absorb Diode laser radiation,
this is shown by the burning but not controlled imaging of the polymer binder of the applied coating and substrate on exposure to Diode laser source.

c) Copper Salt **not** in combination with "Colour Forming" Component does not significantly absorb CO_2 laser radiation,
this is shown by slight burning but not controlled imaging of the applied coating on exposure to CO_2 laser source.

d) "Colour Forming" Component **not** in combination with Copper Salt does not significantly absorb Diode laser radiation,
this is shown by no effect of the applied coating on exposure to Diode laser source.

e) "Colour Forming" Component **not** in combination with Copper Salt does absorb some CO_2 laser radiation,

this is shown by an effect of the applied coating and production of a WEAK COLOURED image on exposure to CO_2 laser source.

CHP – Copper (II) Hydroxy Phosphate

CPPH – Copper (II) Pyrophosphate Hydrate

Initial colour of coating and image achieved on activation is not limited. Theoretically any initial or final colour (RED, BLUE, GREEN etc.) is achievable and the energy required to develop the image can be within a range.

"Water-Based Inks" range

- Water-based inks with dispersed Pergascript colour formers Blue I2RN, Blue SRB-P and Red I6B in acrylic-emulsion has been partly evaluated. Using additions at suitable concentrations of CHP and CPPH strong, well-defined and distinct colour changes have been demonstrated with the Prototype Diode Laser and CO_2 Laser when applied by K-bar on different substrates.

(see Tables 1, 2 and 3)

Typical "Inactive" Ink Formulation (I) (% w/w)

Binder	40
Copper Salt	5
Fluid (Water/Surfactant etc.)	55

Typical "Inactive" Ink Formulation (II) (% w/w)

Binder	40
Colour Former	5
Fluid (Water/Surfactant etc.)	55

Typical "Active" Ink Formulation (% w/w)

Binder	38
Colour Former	5
Fluid (Water/Surfactant etc.)	52
Copper Salt IR absorber	5

Copper Salt e.g. Copper(II) Hydroxy Phosphate, Copper(II) Pyrophosphate Hydrate etc

Binder	e.g.	Gohsenol GH-17 polyvinylalcohol, Scott Bader Texicryl 13-011 etc.
Colour Former	e.g.	Pergascript Blue I-2RN, Blue SRB-P Red I-6B, Black IR etc.
Fluid	e.g.	water etc.
Pigment	e.g.	Zinc Stearate etc.

Table 1 - Sample Formulation

(for laser imaging evaluation of Example see Table 2)

Example	Component	% w/w
A	Scott Bader Texicyryl 13-011	40
	Copper (II) Hydroxy Phosphate	5
	Fluid	55
B	Scott Bader Texicyryl 13-011	40
	Pergascript Red I6B	5
	Fluid	55
C	Scott Bader Texicyryl 13-011	40
	Pergascript Blue SRB-P	5
	Fluid	55
D	Scott Bader Texicyryl 13-011	38
	Copper (II) Hydroxy Phosphate	5
	Pergascript Blue SRB-P	5
	Fluid	52
E	Scott Bader Texicyryl 13-011	38
	Copper (II) Hydroxy Phosphate	5
	Pergascript Red I6B	5
	Fluid	52
F	Scott Bader Texicyryl 13-011	38
	Copper (II) Pyrophosphate Hydrate	5
	Pergascript Blue SRB-P	5
	Fluid	52

G	Scott Bader Texicyryl 13-011	38
	Copper (II) Pyrophosphate Hydrate	5
	Pergascript Red I6B	5
	Fluid	52

Table 2 – Diode Laser Imaging Evaluation

(for formulation of Example see Table 1)

Type	Copper Salt Type	Level % w/w	Unimaged	Exposed (~ 830 nm)
A	CHP	5	Off-White Green	Burning
B	n/a	0	Off-White	None
C	n/a	0	Off-White	None
D	CHP	5	Off-White Green	PINK PURPLE
E	CHP	5	Off-White Green	BLUE
F	CPPH	5	Off-White Green	PINK PURPLE
G	CPPH	5	Off-White Green	BLUE

Table 3 – CO_2 Laser Imaging Evaluation

(for formulation of Example see Table 1)

Type	Copper Salt Type	Level % w/w	Unimaged	Exposed (10000 nm)
A	CHP	5	Off-White Green	Slight Burning
B	n/a	0	Off-White	WEAK PINK PURPLE
C	n/a	0	Off-White	WEAK BLUE
D	CHP	5	Off-White Green	PINK PURPLE
E	CHP	5	Off-White Green	BLUE
F	CPPH	5	Off-White Green	PINK PURPLE
G	CPPH	5	Off-White Green	BLUE

<u>"Solvent-Based Inks" range</u>

- Solvent-based acrylic-solution inks with dispersed Pergascript colour former Red I6B has been partly evaluated. Using additions at suitable concentrations of CHP and CPPH colour changes have been demonstrated with the Prototype Diode Laser and CO_2 Laser when applied by K-bar on different substrates. Imaging sensitivity may be improved by addition of one or more sensitiser materials.

Typical "Inactive" Ink Formulation (I) (% w/w)

Binder	26
Colour Former	5
Fluid (Alcohol/Ester etc.)	69

Typical "Inactive" Ink Formulation (II) (% w/w)

Binder	26
Copper Salt IR-absorber	5
Fluid (Alcohol/Ester etc.)	69

Typical "Active" Ink Formulation (% w/w)

Binder	24
Colour Former	5
Fluid (Alcohol/Ester etc.)	66
Copper Salt IR-absorber	5

Copper Salt	e.g.	Copper(II) Hydroxy Phosphate, Copper(II) Pyrophosphate Hydrate etc
Binder	e.g.	Ineos Elvacite 2013, 2028, 2043, Pioloform PolyvinylButyral etc.
Colour Former	e.g.	Pergascript Blue I-2RN, Blue SRB-P Red I-6B, Black IR etc.
Fluid	e.g.	Ethanol, Ethyl Acetate etc.
Pigment	e.g.	Zinc Stearate etc.

This work has not been satisfactorily completed.

Experimental Method

- Inks were prepared by dispersing Copper Salt and "Colour Forming" Component materials in water based emulsions or solutions of polymer binder and solvent based solutions of polymer binder using stirring and milling.
- Coatings were prepared by application onto paper, board or foil substrate with 1 or 2 x K-bar 2.5 and hot-air drying.
- Coated substrates were exposed to Diode or CO_2 Laser sources and the effect evaluated.

Summary

a) Water-borne dispersion of Copper Salt and "Colour Forming" Component in polymer solution or emulsion.

b) Solvent-borne dispersion of Copper Salt and "Colour Forming" Component in polymer solution.

c) Solvent-borne dispersion of Copper Salt and solution of "Colour Forming" Component in polymer solution.

i) The colour change characteristics of the ink type was evaluated on various substrates **with** suitable Copper Salt **and** "Colour Forming" component. Distinct colour change can be initiated with a near-IR source where the image achieved and the energy input required are controlled by the formulation of the ink. Therefore exposure of a coating applied from the ink to an appropriate IR source such as Diode or CO_2 Laser will produce a distinct image dependent upon the ink type.

ii) The colour change characteristics of the ink type was evaluated on various substrates **without** suitable Copper Salt but **with** suitable "Colour Forming" component.

Distinct colour change can **not** be initiated with a near-IR source where the failure is controlled by the formulation of the ink. Therefore exposure of a coating applied from the ink to an appropriate activating IR source such as CO_2 Laser or Diode Laser will not produce a distinct image dependent upon the ink type.

iii) The colour change characteristics of the ink type was evaluated on various substrates **with** suitable Copper Salt but **without** suitable "Colour Forming" component.

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Potential Scope and Future Work

Due to the remarkable character of the ink/coatings in producing a coloured image on exposure to Diode Laser wavelengths when including a Copper Salt and "colour forming" component, this may be further exploited by differentiating between activating sources and to produce a range of different colours.

Ink Type a) - Water-Based Inks

The Copper Salt IR-absorber can be one or more of a range of materials such as copper(II) hydroxide phosphate, copper(II) pyrophosphate hydrate etc.

The colour former can be one or more of a range of established basic dyes such as fluorans, pthalides etc.

The binder can be one or more of a range of water soluble, alkali soluble or emulsion polymers such as polyvinyl alcohol, styrene acrylic, hydroxypropyl cellulose, etc.

The fluid can be one or more of a range of water compatible liquids etc.

One or more of a range of additives can be utilised, surfactants or lubricants such as zinc stearate etc.

The IR sensitive coating can be applied by a range of methods such as flood coating, flexo/gravure etc.

The IR sensitive coating can be applied to a range of substrates such as paper, paperboard, flexible plastic film, corrugate board etc.

Ink Type b) - Solvent-Based Inks

The Copper Salt IR-absorber can be one or more of a range of materials such as copper(II) hydroxide phosphate, copper(II) pyrophosphate hydrate etc.

The binder can be one or more of a range of solvent soluble polymers such as acrylic etc.

The binder can be one or more of a range of solvent soluble polymers such as acrylic, polyvinylbutyral, nitrocellulose etc.

The fluid can be one or more of a range of solvents such as ethanol, ethylacetate, isopropanol, methylethylketone etc.

One or more of a range of additives can be utilised, surfactants or lubricants such as zinc stearate etc.

The IR sensitive coating can be applied by a range of methods such as flood coating, flexo/gravure etc.

The IR sensitive coating can be applied to a range of substrates such as paper, paperboard, flexible plastic film, corrugate board etc

Potential further types of medium for Copper Salt / "Colour Former" component applications,

UV curable flexographic inks,
UV curable offset inks,
Conventional offset inks,
Melt extrudable polymer,
Powder Coatings, Etc.